Kelly KLS8080I/IPS Motor Controller User's Manual

KLS72501-8080I	**KLS72601-8080I**	**KLS72701-8080I**
KLS96501-8080I	**KLS96601-8080I**	**KLS12401-8080I**
KLS12601-8080I	**KLS14201-8080I**	**KLS14301-8080I**
KLS72501-8080IPS	**KLS72601-8080IPS**	**KLS72701-8080IPS**
KLS96501-8080IPS	**KLS96601-8080IPS**	**KLS12401-8080IPS**
KLS12601-8080IPS	**KLS14201-8080IPS**	**KLS14301-8080IPS**

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Chapter 1 Introduction

1.1 Overview

This manual introduces the Kelly sinusoidal wave brushless BLDC motor controllers' features, their installation and their maintenance. Read the manual carefully and thoroughly before using the controller. If you have any questions, please contact the support center of Kelly Controls, LLC.

Kelly's programmable motor controllers provide efficient, smooth and quiet controls for electric motorcycles, golf carts and go-carts, as well as industrial motor control. It is mainly supposed to solve noise problems of BLDC motor driving application. KLS controller can not support sensorless brushess motor for now.Compared to the traditional trapezoidal waveform control technology, this technique based on sinusoidal wave driving technology to reduce the operation noise and 1/3 switching loss, which well meets the noise reduction and efficiency requirements in the application of DC brushless motor. It uses high power MOSFET's and, SVPWM and FOC to achieve efficiencies of up to 99% in most cases. A powerful microprocessor brings in comprehensive and precise control to the controllers. It also allows users to adjust parameters, conduct tests, and obtain diagnostic information quickly and easily.People can program the KLS controller on PC software and Android App.There is one more choice for customers to program KLS controller now.The APP software is based on Tablet with Android OS.Customers may add a Z-TEK USB to RS232 cable for programming KLS controller if they want to use Android Tablet.

Both PC software and Android APP can provide one screen to monitor the controller parameters.Sometimes people can use a small Android Tablet as display device.

KLS8080I/IPS is designed by opto-isolated technology.We specify 8-30V for power supply which must be isolated from main battery pack B+/B-.You may use an isolated DCDC converter or a separate 12V battery for power supply.KLS8080I is supposed to work with BLDC motor with hall sensors.KLS8080IPS can work with brushless motor with Sin/Cosin speed sensors.

KLS8080I/IPS controller included the fuse and shunt on the case.

Chapter 2 Features and Specifications

2.1 General functions

(1) Extended fault detection and protection. Customers can read the error code in PC software or Android Tablet also.
(2) Monitoring battery voltage. It will stop driving if the battery voltage is too high and it will progressively cut back motor drive power as battery voltage drops until it cuts out altogether at the preset "Low Battery Voltage" setting.
(3) Built-in current loop and over current protection.
(4) Configurable motor temperature protection range.
(5) Current cutback at low temperature and high temperature to protect battery and controller. The current begins to ramp down at 90℃ case temperature, shutting down at 100℃.
(6) The controller keeps monitoring battery recharging voltage during regen braking.
(7) Maximum reverse speed and forward speed can be configured between 20% and 100% respectively and separately.
(8) A 4pin connector to RS232 port and a Z-TEK USB to RS232 cable allows for configuration, programming and software upgrades using the tablet which must be based on Android OS now.People can do the same things on PC software by using a standard USB to RS232 cable instead.
(9) Provision of a +5 volt and +12 volt output to supply various kinds of hall sensors.
(10) 5 switch inputs which are activated by connection to 12V. Default to throttle switch, brake switch,reversing switch,forward switch and Boost switch.
(11) 2 analog 0-5V inputs that default to throttle input, and motor temperature input
(12) Copy signal of one of sensors.
(13) Configurable boost switch. Enables the maximum output power achievable if the switch is turned on.
(14) 12V brake switch input used different port from motor temperature sensor.You can use both brake switch and motor temperature sensor functions at the same time on the latest version.Pin 25 is 12V brake switch input port.Pin1 is motor temperature sensor input port.
(15) Optional joystick throttle. A bi-symmetrical 0-5V signal for both forward and reversing.
(16) Configurable motor over-temperature detection and protection with the recommended thermistor KTY84-130 or KTY84-150.
(17) 3 hall position sensor inputs. Open collector, pull up provided.Sin/Cosin Speed sensors inputs.
(18) Enhanced regen brake function. A novel ABS technique provides powerful and smooth regen.The regen can happen at any speeds until zero speed.
(19) Cruise control.
(20) KLS-8080I/IPS can support Broadcast type CAN bus function.It is 250Kbps.

Caution! *The regen is not a safe function.Usually you may use the mechanical brake.*

2.2 Features

1) Intelligence with powerful microprocessor.
2) Synchronous rectification, ultra low drop, fast SVPWM and FOC to achieve very high efficiency.
3) Electronic reversing.
4) Voltage monitoring on 3 motor phases, bus, and power supply.
5) Voltage monitoring on voltage source 12V and 5V.
6) Current sense on all 3 motor phases.
7) Current control loop.
8) Hardware over current protection.
9) Hardware over voltage protection.
10) Configurable limit for motor current and battery current.
11) Low EMC.
12) Battery protection: current cutback, warning and shutdown at configurable high and low battery voltage.
13) Rugged aluminum housing for maximum heat dissipation and harsh environment.
14) Rugged high current terminals, and rugged aviation connectors for small signal.
15) Thermal protection: current cut back, warning and shutdown on high temperature.
16) Controller can do auto_Identification angle for different Sine/Cosine Speed sensors.Can adjust the zero-crossing point and signal amplitude to match different Sine/Cosine speed sensors.
17) Configurable high pedal protection: the controller will not work if high throttle is detected at power on.
18) Current multiplication: Take less current from battery, output more current to motor.
19) Easy installation: 3-wire potentiometer will work.
20) Standard PC/Laptop computer to do programming.There is one more choice for customers to program KLS controller.Standard Tablet with Android OS to do programming.Need a Z-TEK USB TO RS232 cable for connecting the controller to App program in Tablet.
21) User program provided. Easy to use. No cost to customers.
22) Support motors with any number of poles.
23) Up to 70,000 electric RPM standard. (Electric RPM = mechanical RPM * motor pole pairs;Motor pole pairs=Motor poles/2).

2.3 Specifications

•Frequency of Operation: 20kHz.
•Standby Battery Current: < 0.5mA.
•5V or 12V Sensor Supply Current: 40mA.
• Controller supply voltage range: PWR, 8V to 30V for pin7 and pin6 which must be isolated from main battery pack B+/B-.
•Supply Current, PWR, 30mA Typical.
•Configurable battery voltage range, B+. Max operating range: 18V to 1.25*Nominal Voltage.
•Standard Throttle Input: 0-5 Volts(3-wire resistive pot), 1-4 Volts(hall active throttle).
•Throttle Input: 0-5 Volts. Can use 3-wire pot to produce 0-5V signal.
•Main Contactor Coil Driver<2A.
•Full Power Operating Temperature Range: 0℃ to 70℃(MOSFET temperature).
•Operating Temperature Range: -40℃to 100℃ (MOSFET temperature).
•Motor Current Limit, 1 minute: 400A - 700A, depending on the model.
•Motor Current Limit, continuous: 200A - 300A, depending on the model.
•Max Battery Current :Configurable.

2.4 Name Regulation

The name regulation of Kelly KLS motor controllers:

KLS 8080I/IPS
KLS:Kelly BLDC motor controller based on sinusoidal waveform.KLS8080I is supposed to work with brushless motor with three hall sensors while KLS8080IPS can work with Sin/Cosin speed sensors.There are +5V,Sin,Cosin and GND I/O ports for brushless motor with Sin/Cosin speed sensors.
I:KLS8080I is designed by opto-isolated technology.We specify 8-30V for power supply which must be isolated from main battery pack B+/B-.

Kelly KLS8080I/IPS Sinusoidal Brushless Motor Controller			
Model	10 seconds Current(Amp)	Continuous Current(Amp)	Voltage(Volt)
KLS72501-8080I/IPS	500	200	24-72
KLS72601-8080I/IPS	600	240	24-72
KLS72701-8080I/IPS	700	280	24-72
KLS96501-8080I/IPS	500	200	24-96
KLS96601-8080I/IPS	600	240	24-96
KLS12401-8080I/IPS	400	160	24-120
KLS12601-8080I/IPS	600	240	24-120
KLS14201-8080I/IPS	200	80	24-144
KLS14301-8080I/IPS	300	120	24-144

Chapter 3 Wiring and Installation

3.1 Mounting the Controller

The controller can be oriented in any position which should be as clean and dry as possible, and if necessary, shielded with a cover to protect it from water and contaminants.

To ensure full rated output power, the controller should be fastened to a clean, flat metal surface with four screws. Applying silicon grease or some other thermal conductive material to contact surface will enhance thermal performance.

Proper heat sinking and airflow are vital to achieve the full power capability of the controller.

The case outline and mounting holes' dimensions are shown in Figure 1.

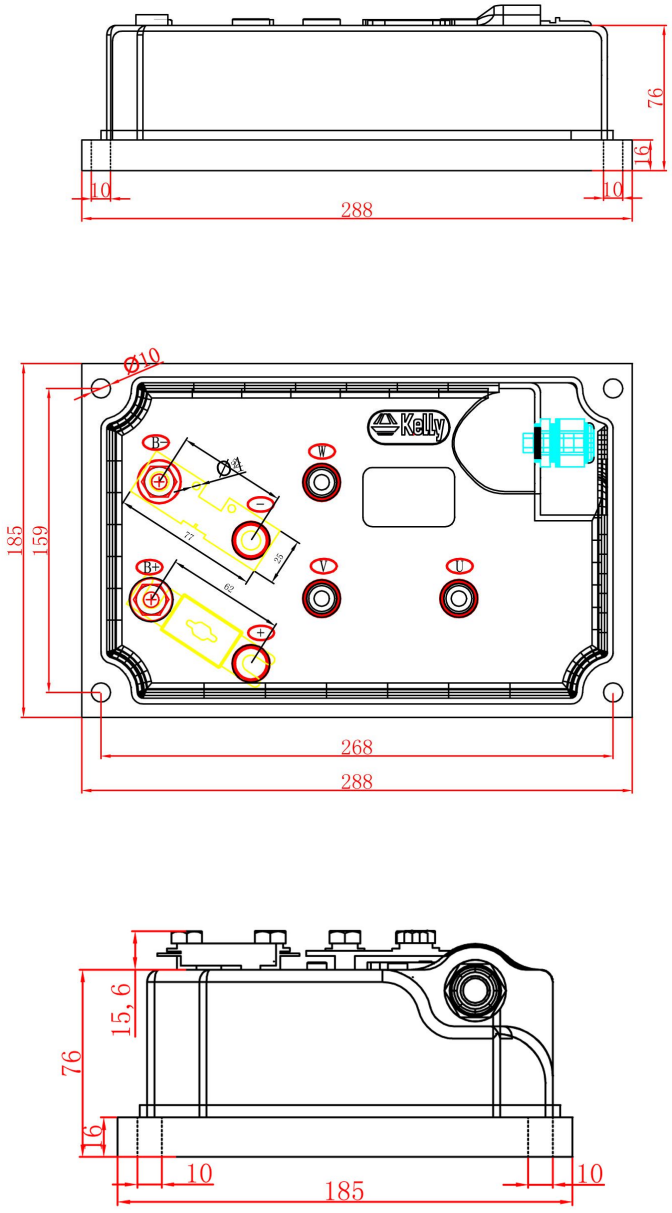

Figure 1:KLS8080I/IPS mounting holes' dimensions (dimensions in millimeters)

3.2 Connections

3.2.1 Pin definition of KLS8080I/IPS Controller

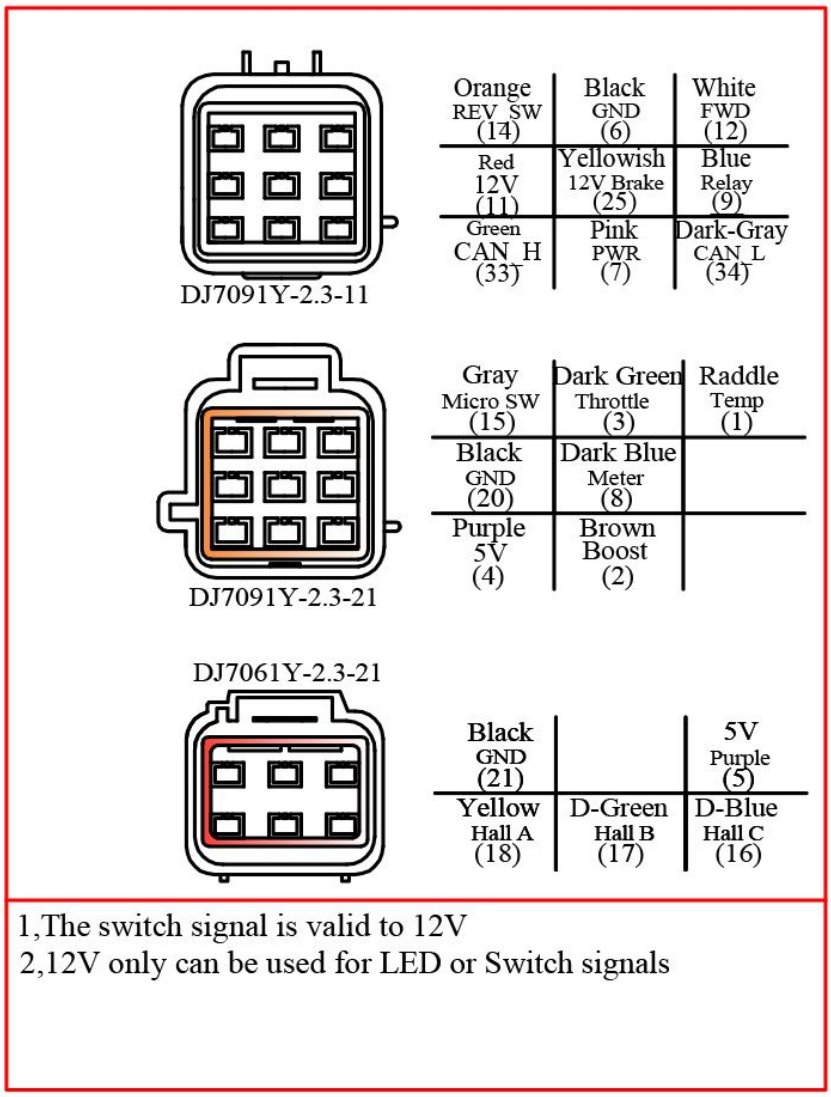

Figure 2:KLS8080I waterproof connector

DJ7091Y-2.3-11 Pin Definition

(14) REV_SW: Reverse switch input. Orange
(6) RTN: Signal return or power supply return. Black
(12) FWD: Forward switch White
(11) 12V:12V Source Red
(25) 12V brake switch. Yellowish
(9) Relay: Main contactor driver. Blue
(33)CAN-H:Green
(7) PWR: Controller power supply (input). Pink
(34)CAN-L:Dark Gray

DJ7091Y-2.3-21 Pin Definition

(15) Micro_SW: Throttle switch input. Gray
(3) Throttle: Throttle analog input, 0-5V. Dark Green
(1) Temp: Motor temperature sensor input. Raddle.
(20) RTN: Signal return. Black
(8) Meter: Copy signal of hall sensors. Dark Blue
(4) 5V: 5V supply output, <40mA. Purple
(2) BOOST: Boost function. Brown

DJ7061Y-2.3-21 Pin Definition

(21) RTN:Signal return. Black
(5) 5V: 5V supply output,<40mA.Purple
(18) Hall A: Hall phase A. Yellow 【This is Sine signal input on KLS8080IPS】
(17) Hall B: Hall phase B. Dark Green 【This is Cosine signal input on KLS8080IPS】
(16) Hall C: Hall phase C. Dark Blue【There is no hall C signal input on KLS8080IPS】

Notes:

1. All RTN pins are internally connected.
2. Meter function is to copy either of hall sensors.
3. Switch to 12V is active. Open switch is inactive.

Caution:

- Do not apply power until you are certain the controller wiring is correct and has been double checked. Wiring faults will damage the controller.
- Ensure that the B- wiring is securely and properly connected before applying power.
- The preferred connection of the system contactor or circuit breaker is in series with the B+ line.
- All contactors or circuit breakers in the B+ line must have precharge resistors across their contacts. Lack of even one of these precharge resistors may severely damage the controller at switch-on.

3.2.2 Standard Wiring of KLS8080I/IPS Controller

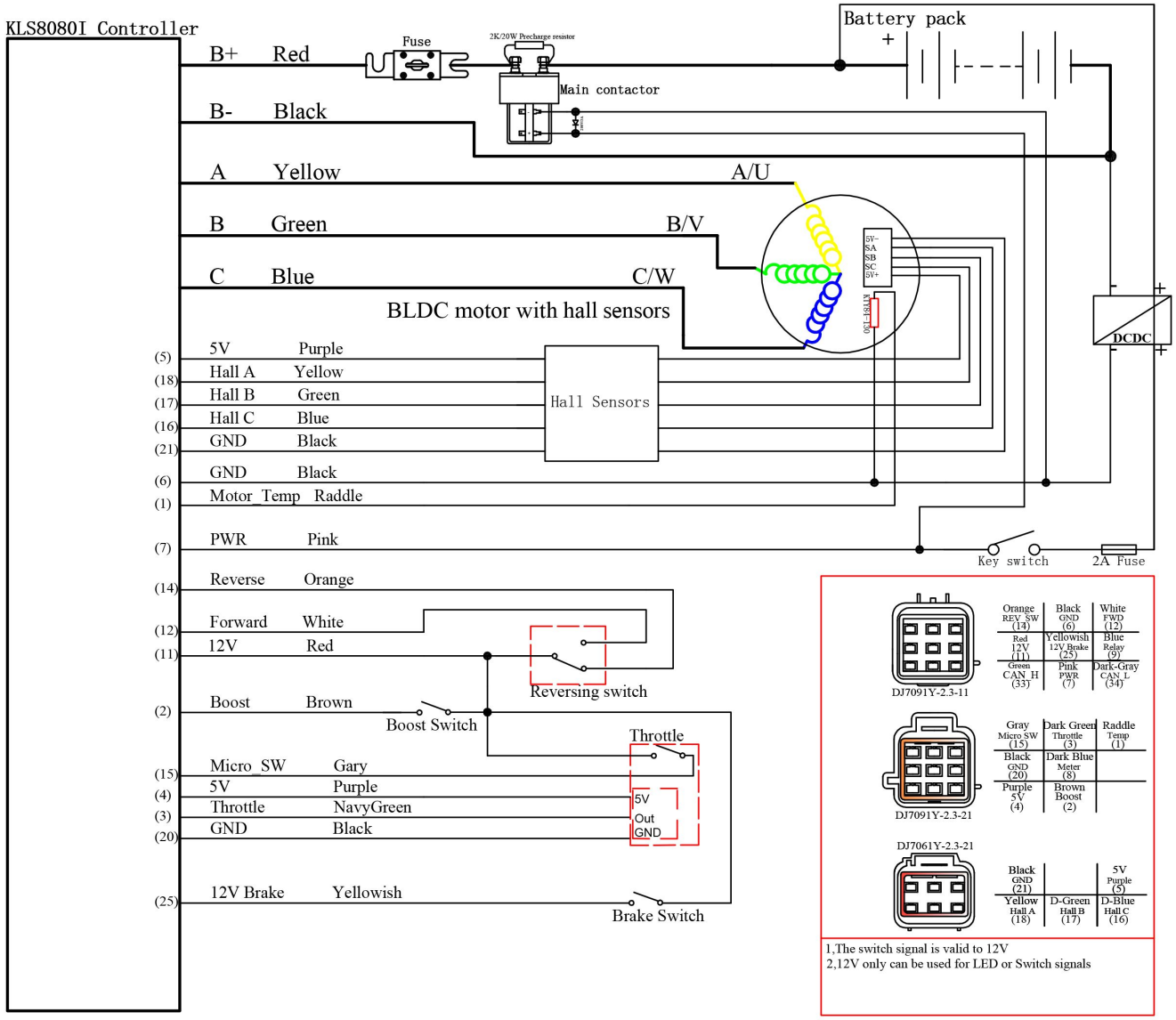

Figure 3: KLS8080I controller standard wiring

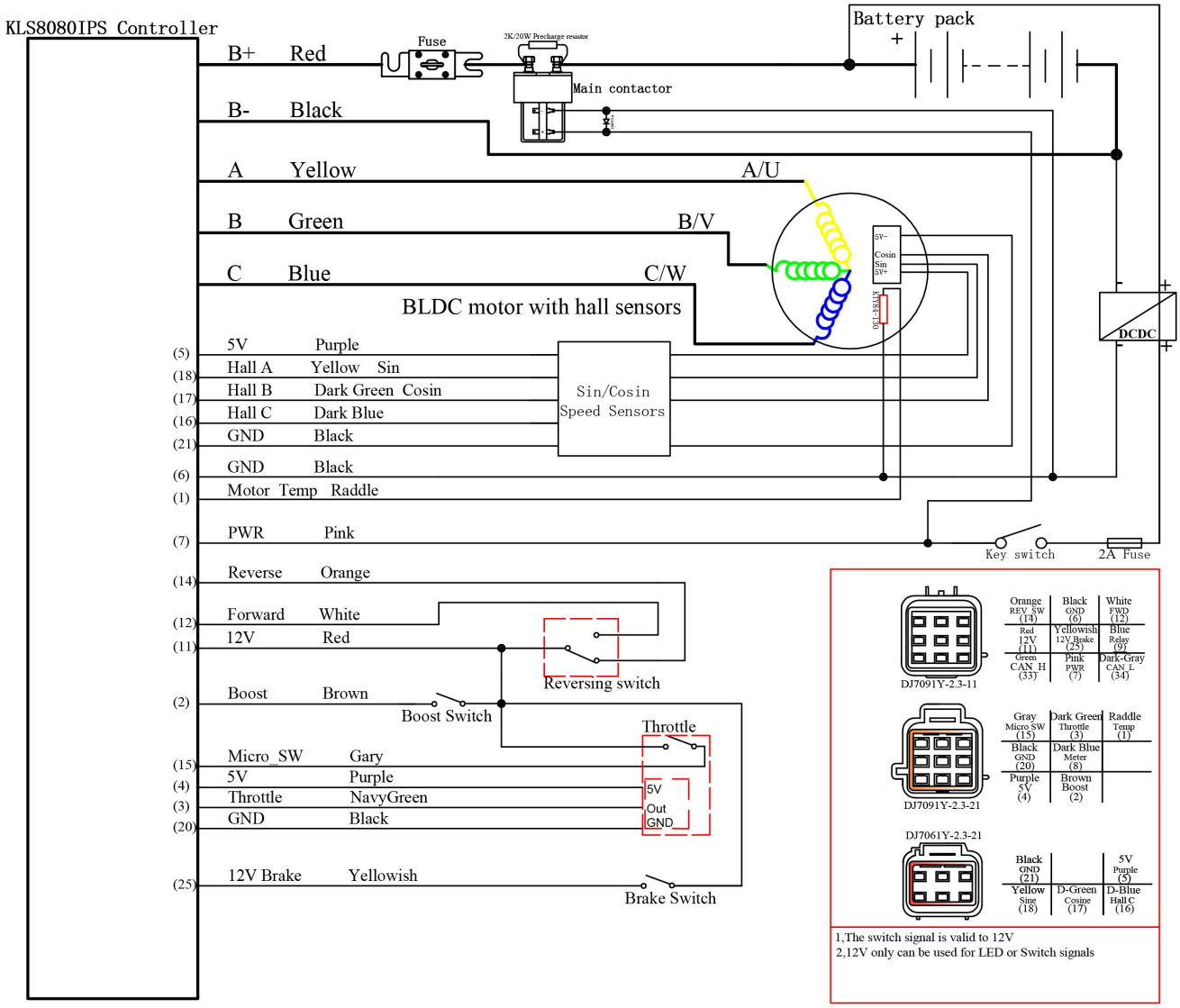

Figure 4: KLS8080IPS controller standard wiring

3.2.3 Optional wiring of KLS8080I/IPS controller

The 12V input signal of the pin supplies the second braking function of the controller.

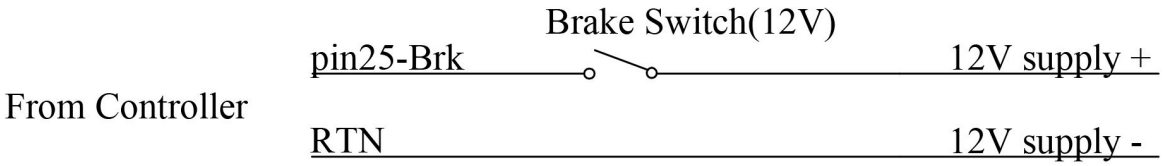

Figure 5: Wiring of brake switch(12V): 12V is provided by external source.

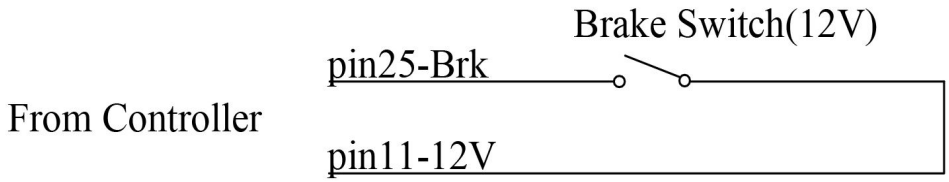

Figure 6: Wiring of brake switch(12V): 12V is provided by KLS8080I controller on pin11

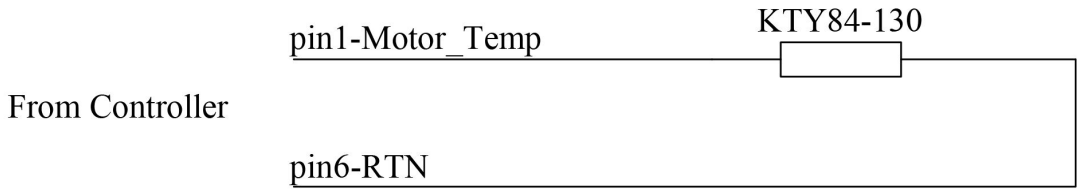

Figure 7: Wiring diagram for motor temperature sensor

NOTE: The motor temperature sensor and brake switch used the same I/O port on pin1.Both functions can not be used at the same time.KLS controller can support KTY84-150 and KTY84-130 thermistors.

3.2.4 Communication Port

A 4pin connector to RS232 port is provided to communicate with host computer for calibration and configuration.

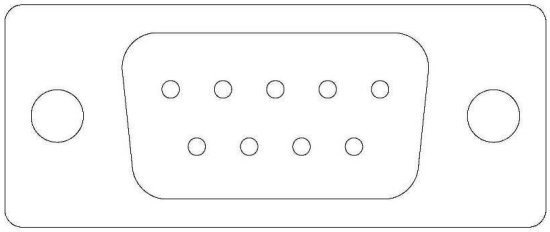

Figure 8: RS232 Interface on 4pin connector to RS232 converter

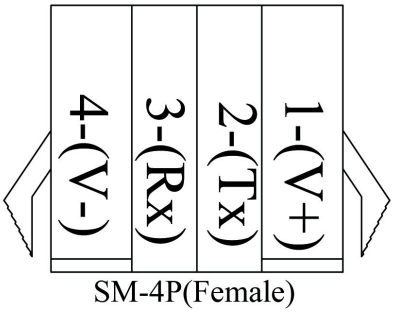

Figure 9： SM-4P connector for communication interface on KLS8080I controller

3.3 Installation Check List

Before operating the vehicle, complete the following checkout procedure. Use LED code as a reference as listed in Table 1.

Caution:
- **Put the vehicle up on blocks to get the drive wheels off the ground before beginning these tests.**
- **Do not allow anyone to stand directly in front of or behind the vehicle during the checkout.**
- **Make sure the PWR switch and the brake is off**
- **Use well-insulated tools.**

- Make sure the wire is connected correctly
- Turn the PWR switch on.
- The fault code will be detected automatically at restart.

- With the brake switch open, select a direction and operate the throttle. The motor should spin in the selected direction. Verify wiring or voltage and the fuse if it does not. The motor should run faster with increasing throttle. If not, refer to the Table 1 code, and correct the fault as determined by the fault code.
- Take the vehicle off the blocks and drive it in a clear area. It should have smooth acceleration and good power.

Chapter 4 Programmable Parameters

KLS Configuration program allow users to set parameters according to the vehicle actual working environment so as to be at its best.

The default parameters of the controller are not recommended for all applications. Make sure set the proper parameters before making any test to avoid danger.

Customers can do program on PC software or Android App.The Android Tablet is prefered.First of all,people need to do Identification angle function for KLS controller before running the motor.The controller needs to be connected to batteries,motor and throttle before Identification operation.That is to say,it is not enough to connect only power supply(PWR=pin7) to batteries for Identification Angle operation.

Please download the instruction how to use Identification angle function from our website. www.kellycontroller.com/support.php

4.1 Step 1

(1)Low Volt: The min voltage of reporting this fault - Range 18~180
Controller will not operate when battery voltage is near the value so as to protect battery.
Suggestion: Set according to the practical situation.By default,it is set at 18V.

(2)Over Volt: The max voltage of reporting this fault - Range 18~180
Controller will not operate when battery voltage is higher than the value so as to protect battery and controller.
Suggestion: Set according to the practical situation.
Here is the max voltage for each model.
72V controller:90V
96V controller:120V
120V controller:136V
144V controller:180V

Controller Rated voltage	Under Voltage Range (V)	Over Voltage Range(V)
72V	18~90	18~90
96V	18~120	18~120
120V	18~136	18~136
144V	18~180	18~180

Figure 4.1

(3)Current Percent: Phase Current Percent. Range: 20~100
Functional description: The max motor current is (The Value * Peak Current of the Controller).
Suggestion: Factory default is 100%.

(4)Battery Limit: Battery Limit Current, Limit the max value of Battery Current. Range: 20~100
Functional description: Set max battery current so as to protect battery. A lower value means a lower battery output current and better protective effect. But excessively low value will affect acceleration.
Suggestion: Factory default is 100%.

(5)Identification Angle: Please download the instruction to how to use Identification angle function from the website.
www.kellycontroller.com/support.php
If you can read 85 in Identification Angle item,that is to say,the system is stable and normal.Please fill in 170 for Identification Angle item in user program.Then
please click Write button in user program.Please wait a few seconds before restart the power supply.You will see some info on Monitor screen after power supply is
reset.If you see Reset error on the Monitor screen,that is to say,the auto_Identification is finished.You can see 85 in the Identification Angle item again.And the controller will
blink error code.This is normal.Please reset the power supply again.Then everything will be fine.The motor is ready to be drived by the KLS controller.
Range: 85 or 170,nothing else.

(6)TPS Low Err: Hall active pedal, if lower than the value, report the fault of TPS Type. Range: 0~20
(7)TPS High Err: Hall active pedal, if higher than the value, report the fault of TPS Type. Range: 80~100
As you may know,the output of hall throttle from Kelly is about from 0.86V to 4.2V.
Our controller will report 3.3 error code if the output of hall throttle is below 0.5V or above 4.5V by default.
The controller will think the hall throttle is shorted or damaged if the output is beyond the range from 0.5V to 4.5V.
You can adjust the threshold voltage below or above 0.5V.The controller will report the 3.3 code to protect the system according to different types of hall throttle.
Because there are many different hall throttle suppliers in the world.The initial output can not be

always in the range of 0.5V to 4.5V.

But it doesn't make any differences if you choose 0-5V or 3-wire pot for the throttle type.That is to say,these two settings are only useful for hall active throttle or pedal when you chose throtle type at 2.

As the same goes,it is valid to adjust the high threshold voltage above 4.5V or below 4.5V.
Usually the hall output voltage is 4.2V Max.If you adjust it to lower value which is near 4.2V,it may trigger the error code in normal way.

(8)TPS Type: TPS Type, 1:0-5V 3-wire 0-5K pot,5K is normal,2K-20K can be used;2:Hall active throttle or pedal. Range: 1~2

(9)TPS Dead Low: TPS Dead Zone Low. Range: 5~40
Functional description: Set throttle effective starting point
Suggestion: Set according to the practical situation, factory default is 20%*5V=1.0V.

(10)TPS Dead High: TPS Dead Zone High. Range: 60~95
Functional description: Set throttle effective ending point
Suggestion: Set according to the practical situation, factory default is 80%*5V=4.0V.

(11)Max output Fre: Max output frequency. Unit:Hz
Functional description:It will affect the top speed of the motor.
Suggestion: Set according to the practical situation, factory default is 1000Hz.Please don't set it 1000Hz above.

(12)Max Speed: Max Speed [rpm]. Range: 0~10000 By default,it is set at 4000.

(13)Max Fwd Speed %: The forward speed of the percentage of maximum speed. Range: 20~100 By default,it is set at 100%

(14)Max Rev Speed %: The reverse speed of the percentage of maximum speed. Range: 20~100 By default,it is set at 100%

(15)PWM Frequency: Frequency of PWM operation. Unit:KHz
Functional description:20KHz is better for hub motor with strict quiet control.
Suggestion: Set according to the practical situation, factory default is 20KHz.Please don't set it 20KHz above.
Value Range:10KHz or 20KHz

(16)Start-up H-Pedal:
Value range: Enable and Disable

Functional description: If enabled, the controller will detect the current pedal status at power up. If throttle got effective output, the controller will report fault and not operate.
Suggestion: Set according to the practical situation, factory default is Enable.

(17)Brake H-Pedal:Releasing Brake High Pedal Disable
Value range: Enable and Disable
Functional description: If enabled, the controller will detect the current pedal status when release the brake. If throttle got effective output, the controller will report fault and not operate.
Suggestion: Set according to the practical situation, factory default is Disable.

(18)NTL H-Pedal:Neutral position High Pedal Disable.Only useful when Three gears switch function is enabled.
If enable,the controller will detect the current pedal position or signal When the switch is in neutral poistion.
If the throttle got effective output signal,the controller will not operate and report fault code.
Suggestion: Set according to the practical situation, factory default is Disable.

(19)Joystick function:
If enable,the controller can drive the motor on two directions without using any reversing switch. Just one single throttle can drive the motor on forward and reversing direction.
The stick shift throttle firmware can be called wig-wag or joystick operation.It is only a software function.Usually It is useful for electric boat project.You still can use the common 0-5K pot or 0-5V throttle for the controller.If you don't choose the joystick,you operated the throttle in this way.The motor speed will increase when the throttle is from 0V to 5V.
If you enable joystick for this controller in user program,you will start the motor from 2.5V position.2.6V to 5V is forward.2.4V to 0V is backward.
2.4V to 2.6V is the throttle dead zone.Customers can adjust the throttle dead zone in user program also.
Please note the common throttle will spring back to original position if you release the throttle.
Suggestion:factory default is Disable.

(20)Three Gears switch:It is used for function of F-N-R control.
Please check the wiring diagram in the manual for F-N-R control.
Suggestion: Set according to the practical situation, factory default is Disable.
(20-A)Three Gears Switch
Value range: Enable and Disable
Functional description: If enabled, the Forward switch will be activated. Please see figure 4.1.
Suggestion: Set according to the practical situation, factory default is Disable.
(20-B)Foot Switch
Value range: Enable and Disable
Functional description: If enabled,the foot switch will be activated.The controller will not accept the throttle signal if the foot switch is turned off. Please see figure 4.1.
Suggestion: Set according to the practical situation, factory default is Disable.

Configuration		Pin Status			Running Status
Forward Switch	Foot Switch	FWD_SW (12)	REV_SW (14)	Foot (15)	
Enable	Disable	OFF	OFF	x	Neutral
		OFF	ON	x	Reverse
		ON	OFF	x	Forward
		ON	ON	x	Neutral
Disable	Enable	x	OFF	OFF	Can't operate
		x	ON	OFF	Can't operate
		x	ON	ON	Reverse
		x	OFF	ON	Forward
Disable	Disable	x	OFF	x	Forward
		x	ON	x	Reverse

Note: X means can be on or off

Figure 4.2

(21)Boost:If enabled,the controller will output max power for a while.
Boost function is just full throttle position when you turn on boost switch even if the throttle is not operated at all.
The boost function is still based on limiting of the motor current and battery current settings in user program.
Suggestion: Set according to the practical situation, factory default is Disable.

(22)Foot switch:It is used for microswitch.If enabled,the controller will only accept the throttle signal after received the valid foot switch signal.
If there is no foot switch signal,the controller will ignore the throttle signal.
Suggestion: Set according to the practical situation, factory default is Disable.

(23)Cruise Control:Value range: Enable and Disable
If enable,if you hold throttle at certain position about 3-4 seconds,the controller will get into Cruise control.
Release throttle and turn the throttle again or turn on the brake switch will make the Cruise control quit.
Suggestion:factory default is Disable.

(24)Change Direction:
If the direction is not what you expected after finish the Identification angle operation,please just choose Change Direction item.
Please click Write button to activate Change Direction function.The motor direction will be what you expected after the power supply is reset.
Suggestion:factory default is Disable.

4.2 Step 2

(1)Motor Poles: Motor Poles, The pair pole number*2. Range: 2~128
Suggestion: Set according to the real motor poles on the nameplate of the motor, factory default is at 8.

(2)Speed Sensor Type: Speed Sensor Type, 2:Hal, 3:Resolver, 4:Line Hall. Range: 2~4
Different sensors type.By defualt,it is set at 2
If you have a motor with 5V,Sin/Cosin,GND speed sensors,please choose it at 4.And please inquire the KLS-8080IPS model before ordering.

(3)Resolver Poles: Resolver Poles, The pair pole number*2. Range: 2~32
It is only used for the Resolver sensor type.

(4)Motor Temp Sensor: Motor Temp Sensor, 0:None, 1:KTY84-130 or 150. Range: 0~1
High Temp Cut Out ° C: Motor High Temp Cut Out, nominal value 130° C. Range: 60~170
Resume ° C: Motor High Temp Resume Temp, nominal value 110° C.The controller will resume work when the motor temp is at 110 degrees inside. Range: 60~170

(5)Line Hall Zero:It is only useful when the speed sensor is at 4.
Zero-Crossing point of Sine/Cosine linear hall sensors output signal.Usually the Sine/Cosine speed sensor supplier provided sensors with 2.5V or 3.0V zero-crossing point.
You can change it back between 2.5V and 3.0V if the motor can not run.
Suggestion: Set according to the practical situation, factory default is 613(3.0V) for Mars 1114/1115/1302/1304 from Motenergy company.
Value Range:0-1023 maps 0-5V

(6)Line Hall Amplitude:The position signal based on Zero-crossing point.It is only useful when the speed sensor is at 4.
For example,if the Line hall Amplitude is 1.1V,the signal output of Sine/Cosine sensors is from 1.9V to 4.1V.(3-1.1=1.9V;3+1.1V=4.1V)
Value Range:0-1023 maps 0-5V

(7)Line Hall High Err:It is only useful when the speed sensor is at 4.
If the signal output of Sine/Cosine speed sensor is above this setting,the controller will report hall error.Please adjust Line Hall High Err to a higher value to eliminate this error.
Value Range:0-1023 maps 0-5V

(8)Line Hall Low Err:It is only useful when the speed sensor is at 4.
If the signal output of Sine/Cosine speed sensor is below this setting,the controller will report hall error also.Please adjust Line Hall Low Err to a lower value to eliminate this error.
Value Range:0-1023 maps 0-5V

4.3 Step 3

(1)RLS_TPS Brk %: RLS TPS Braking Percent, the percent of Releasing Pedal BRK in max braking. Range: 0~50
This is used to adjust the regen current of releasing throttle regen mode type.The regen will happen as long as the throttle is released completely.
Factory set is 0

(2)NTL Brk %: NTL Braking Percent, the percent of Neutral Braking in max braking. Range: 0~50
Only useful when you enable Three gears switch in user program.
The regen will happen when you turn F-N-R switch from Forward or backward to Neutral position.
Factory set is 0

(3)Accel Time: Accel Time, the time of TPS Torque from 0 to max, accuracy 0.1s, 5 is equal to 0.5s. Range: 1~250
Factory set is 10

(4)Accel Rls Time: Accel Release Time, the time of TPS Torque from max to 0, accuracy 0.1s. Range: 1~250
Factory set is 1

(5)Brake Time: Brake Time, the time of Brake Torque from 0 to max, accuracy 0.1s. Range: 1~250
Factory set is 15

(6)Brake Rls Time: Brake Release Time, the time of Brake Torque from max to 0, accuracy 0.1s. Range: 1~250
Factory set is 1

(7)BRK_SW Brk %: BRK_SW Braking Percent, the percent of BRK_SW in max braking. Range: 0~50
The brake switch regen mode.You have to turn on the brake switch after the throttle is released for the regen to occur.
Factory set is 10

(8)Torque Speed KP: Speed Percent Kp in Torque Mode. Range: 0~10000 Factory set is 3000
Torque Speed KI: Speed Integral Ki in Torque Mode. Range: 0~500 Factory set is 80
Speed Err Limit: Speed Error Limit in Torque Mode. Range: 50~4000 Factory set is 1000
These three parameters are used for PID adjustment.
If you think the acceleration performance is very very strong,please adjust them to a lower value respectively.

(9)Change Dir brake:Value range: Enable and Disable
It is only useful when you Enable the joystick function.
If you want to get swift direction changing by using joystick function,you may enable Change Dir brake item in user program.
It will help the motor change the direction of motor quickly after you shift throttle from 0V to 5V,or from 5V to 0V.
Suggestion:factory default is Disable.

Note: Thermistor is optional. Default to KTY84-130 or 150

Chapter 5 Maintenance

There are no user-serviceable parts inside the controllers. Do not attempt to open the controller as this will void your warranty. However, periodic, exterior cleaning of the controller should be carried out.

The controller is a high powered device. When working with any battery powered vehicle, proper safety precautions should be taken that include, but are not limited to, proper training, wearing eye protection, avoidance of loose clothing, hair and jewelry. Always use insulated tools.

5.1 Cleaning

Although the controller requires virtually no maintenance after properly installation, the following minor maintenance is recommended in certain applications.

- Remove power by disconnecting the battery, starting with battery positive.
- Discharge the capacitors in the controller by connecting a load (such as a contactor coil, resistor or a horn) across the controller's B+ and B- terminals.
- Remove any dirt or corrosion from the bus bar area. The controller should be wiped with a moist rag. Make sure that the controller is dry before reconnecting the battery.
- Make sure the connections to the bus bars, if fitted are tight. To avoid physically stressing the bus bars use two, well-insulated wrenches.

5.2 Configuration

You can configure the controller with a host computer through either an RS232 or USB port.

- Disconnect motor wiring from controller for configuring existing parameters in the user program or Android APP. If this operation is too much extra job for you, please make sure the motor must be stopped before programming.
- The controller may display fault code, but it doesn't affect programming or configuration.But it will affect the Identification angle operation.Please try to eliminate the

error codes before Identification angle operation.

- Use a straight through RS232 cable or USB converter provided by Kelly to connect to a host computer. Provide >+18V to PWR（for a 24V controller, provide >+8V）. Wire power supply return(supply negative) to any RTN pin.
- KLS controller requires a 4pin connector to Kelly RS232 Converter to support the communication.And customers may need a Z-TEK USB cable for Tablet with Android OS.

Customers may download PC software or Android APP to program the controller before running the motor.You may do Identification angle for brushless motor with hall sensors after running the software or Android APP.Every item in the configuration program can show the explanation automatically when you click it.

Caution:

- **Make certain that the motor is connected before trying to run Identification angle function in the configuration software.The controller needs to be connected to batteries,motor and throttle before Identification operation.That is to say,it is not enough to connect only power supply(PWR=pin7) to batteries for Identification Angle operation.**
- **Configuration software will be regularly updated and published on the website. Please Update your Configuration Software regularly. You must uninstall the older version before updating.**
- **Please try to use Identify function for motor and hall sensors in the user program**

Table 1: ERROR CODES

Buzzer Error Codes

Code		Explanation	Solution
1,1	¤ ¤	Automatic error identification	1. Wrong wiring of motor phase line or hall. Please suspend the motor when enable Auto-Identify function.
1,2	¤ ¤¤	Over voltage error	2. Battery voltage is too high for the controller. Check battery volts and configuration. 3. Regeneration over-voltage. Controller will have cut back or stopped regen. 4. This only accurate to ± 2% upon Overvoltage setting.
1,3	¤ ¤¤¤	Low voltage error	1. The controller will clear after 5 seconds if battery volts returns to normal. 2. Check battery volts & recharge if required.

1,4	¤ ¤¤¤¤	Over temperature warning	1. Controller case temperature is above 90℃. Current will be limited. Reduce controller loading or switch Off until controller cools down. 2. Clean or improve heatsink or fan.
2,1	¤¤ ¤	Motor did not start	Motor did not reach 25 electrical RPM within 2 seconds of start-up. Hall sensor or phase wiring problem.
2,2	¤¤ ¤¤	Internal volts fault	1. Measure that B+ & PWR are correct when measured to B- or RTN. 2. There may be excessive load on the +5V supply caused by too low a value of Regen or throttle potentiometers or incorrect wiring. 3. Controller is damaged. Contact Kelly about a warranty repair.
2,3	¤¤ ¤¤¤	Over temperature	The controller temperature has exceeded 100℃. The controller will be stopped but will restart when temperature falls below 80℃.
2,4	¤¤ ¤¤¤¤	Throttle error at power-up	Throttle signal is higher than the preset 'dead zone' at Power On. Fault clears when throttle is released.
3,1	¤¤¤ ¤	Frequent reset	May be caused by over-voltage, bad motor intermittent earthing problem, bad wiring, etc.
3,2	¤¤¤ ¤¤	Internal reset	May be caused by some transient fault condition like a temporary over-current, momentarily high or low battery voltage. This can happen during normal operation.
3,3	¤¤¤ ¤¤¤	Hall throttle is open or short-circuit	When the throttle is repaired, a restart will clear the fault.
3,4	¤¤¤ ¤¤¤¤	Non-zero throttle on direction change	Controller won't allow a direction change unless the throttle or speed is at zero. Fault clears when throttle is released.
4,1	¤¤¤¤ ¤	Regen or Start-up over-voltage	Motor drive is disabled if an over-voltage is detected at start-up or during regen. The voltage threshold detection level is set during configuration.
4, 2	¤¤¤¤ ¤¤	Hall sensor error	1. Incorrect or loose wiring or a damaged hall sensor. 2. Also be caused by incorrect hall angle configuration (60 degree or 120 degree)
4, 3	¤¤¤¤ ¤¤¤	Motor over-temperature	Motor temperature has exceeded the configured maximum. The controller will shut down until the motor temperature cools down.

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